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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/783,520	02/20/2004	Stefan Peter Hau-Riege	IL-11154	7476

7590 06/26/2006

Deputy Laboratory Counsel
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EXAMINER

NGUYEN, SANG H

ART UNIT	PAPER NUMBER
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2877

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/783,520

Applicant(s)

HAU-RIEGE, STEFAN PETER

Examiner

Sang Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-67 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11-20 is/are rejected.
- 7) ☒ Claim(s) 10, 21-65 and 67 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/20/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

Figures 1A-1B, 2A-2B, and 3A-3C should be designated by a legend such as -- Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the **"a series of areas of said sample"** in claims 1 and 9; the **"a series of two-dimensional diffraction patterns"** in claim 1; the **"a three dimensional diffraction pattern"** in claim 1 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate

changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claim 21 is objected to because of the following informalities:

Claim 21 recites the limitation "the thickness" in line 4. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

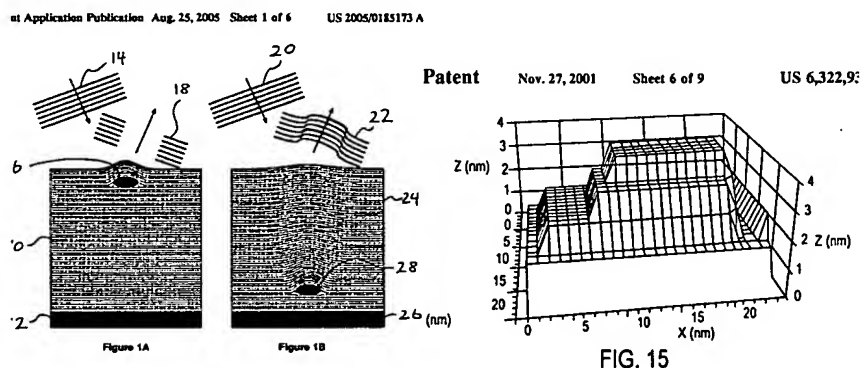
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-4, , 7-8, 11, and 13-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention (Figures 1A-3C) in view of Smith (U.S. Patent No. 6,322,935).

Regarding claims 1 and 15; Prior Art of Present Invention discloses a method for characterizing and repairing defects, comprising:

providing a sample (i.e., a substrate [12 of figure 1A] and a multiplayer [10 of figure 1A]) for testing for the location of a defect (16 of figure 1A) within said sample (10, 12 of figure 1A);

illuminating a beam (14 of figure 1A) with a series of areas (16, 28 of figures 1A-1B or 40, 42, 44 of figures 3A-3C) of said sample (10, 12 of figure 1A) to create a series of two-dimensional diffraction patterns (figures 1A-1B). see figures 1A-1B, 2A-2C, and 3A-3C.



PAPI discloses all of features of claimed invention except for step of producing a three dimensional diffraction pattern from said series of two-dimensional diffraction patterns; computationally producing a reconstructed image of said sample from said three dimensional diffraction pattern; determining the location of said defect within said sample from said reconstructed image; and repairing said defect by applying an appropriate repair technique depending upon the location of said defect within said sample. However, Smith teaches that it is known in the art to provide a method and apparatus for repairing defect comprising producing a three dimensional diffraction

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pattern (figure 15-16) from said series of two-dimensional diffraction patterns (figure 14) by an apparatus (420 of figure 21), wherein the apparatus having an analyzing (422 of figure 21), a three dimensional analyze means (428 of figure 21), a microprocessor (438 of figure 21), and correcting or eliminating means (434 of figure 21); computationally producing a reconstructed image of said sample (figures 15-16) from said three dimensional diffraction pattern by an analyzing (422 of figure 21) and a three dimensional analyze means (428 of figure 21); determining the location of said defect within said sample from said reconstructed image by a microprocessor (438 of figure 21); and repairing said defect by applying an appropriate repair technique depending upon the location of said defect within said sample by correcting or eliminating means (434 of figure 21). See figures 1-21.

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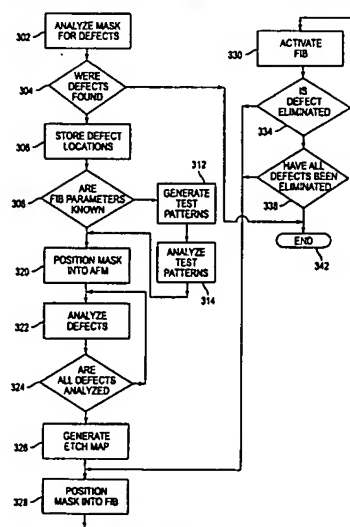


FIG. 20

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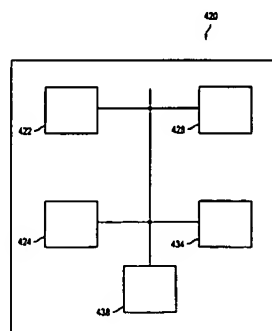


FIG. 21

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the method of PAPI with step of producing a three dimensional diffraction pattern from said series of two-dimensional diffraction patterns; computationally producing a reconstructed image of said sample from said three dimensional diffraction pattern; determining the location of said defect within said sample from said reconstructed image; and repairing said defect by applying an appropriate repair technique depending upon the location of said defect within said sample as taught by Smith for the purpose of correcting and reducing of defects pattern on the photomask.

Regarding claim 3; PAPI discloses said beam comprises extreme ultraviolet light (paragraph 005)

Regarding claim 4; PAPI discloses all of features of claimed invention except for a wavelength of 13.7 nm. It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the method of PAPI with a wavelength of 13.7 nm of EUV light, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. in re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 7; PAPI discloses said beam comprises an electron beam (paragraph 007, for example, FIB).

Regarding claim 8; PAPI discloses said beam is elastically scattered by said defect (16 of figure 1A) of sample (10 of figure 1A).

Regarding claim 11; PAPI discloses all of features of claimed invention except for capturing said series of two-dimensional diffraction patterns prior to producing a three dimensional diffraction pattern. However, Smith teaches that it is known in the art to provide the apparatus (420 of figure 21) for capturing said series of two-dimensional diffraction patterns prior to producing a three dimensional diffraction pattern (figures 14-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the method of PAPI with step of capturing said series of two-dimensional diffraction patterns prior to producing a three dimensional diffraction pattern as taught by Smith for the purpose of correcting and reducing of defects pattern on the photomask.

Regarding claim 13; PAPI discloses said sample comprises an EUVL multilayer film (10 of figure 1A).

Regarding claim 14; PAPI discloses said beam is focused (paragraph 0007).

Regarding claims 16-17; PAPI discloses all of features of claimed invention except for said technique for image reconstruction from diffraction patterns comprises an iterative algorithm and a phase retrieval algorithm. However, Smith teaches that it is known in the art to provide said technique of the apparatus (420 of figure 21) for image reconstruction from diffraction patterns comprises an iterative algorithm and a phase retrieval algorithm (abstract and figures 14-16 and 29-31). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the method of PAPI with step of said technique for image reconstruction from diffraction

patterns comprises an iterative algorithm and a phase retrieval algorithm as taught by Smith for the purpose of correcting and reducing of defects pattern on the photomask.

Regarding claim 18; PAPI discloses said sample comprises a multilayer of Mo/si (paragraph [0005]).

Regarding claims 19-20; PAPI in view of Smith discloses all of features of claimed invention except for said sample a magnetic thin film/ a CU film. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to the method of PAPI with said sample made of a magnetic thin film/ a CU film, sine it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention in view of Smith as applied to claim 1 above, and further in view of Bihringer et al (U.S. Patent No.4,751,169).

Regarding claim 2; PAPI in view of Smith discloses all of feature of claimed invention except for said beam comprises an X-ray beam. However, Behringer et al teaches that it is known in the art to provide said beam comprises an X-ray beam (col.1 lines 20-25). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine PAPI with said beam comprises an X-ray beam as taught by Behringer et al for the purpose of repairing accurately defects transmission mask.

Claim 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention in view of Smith as applied to claim 1 above, and further in view of Kikuchi et al (U.S. Patent No. 6, 801,650).

Regarding claim 5; PAPI in view of Smith discloses all of feature of claimed invention except for said harmonic of said extreme ultraviolet light of 13.7 nm. However, Kikuchi et al teaches that it is known in the art to provide said beam comprises a harmonic of said extreme ultraviolet light (col.14 lines 45-67). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine PAPI with said beam comprises a harmonic of said extreme ultraviolet light as taught by Kikuchi et al for the purpose of high resolution using harmonic UV.

Regarding claim 6; PAPI discloses all of features of claimed invention except for harmonics of wavelength of 13.7 nm. It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the method of PAPI with a wavelength of 13.7 nm of EUV light, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention in view of Smith as applied to claim 1 above, and further in view of Lin et al (U.S. Patent No. 6, 091,846).

Regarding claim 9; PAPI in view of Smith discloses all of feature of claimed invention except for said series of areas are selected by rotating said sample. However,

Lin et al teaches that it is known in the art to provide said series of areas are selected by rotating said sample using movable stage (figure2 and abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine PAPI with said series of areas are selected by rotating said sample as taught by Lin et al for the purpose of selecting and classifying accurately defects on the sample.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention in view of Smith as applied to claims 1 and 11 above, and further in view of Lin et al (U.S. Patent No. 6,864,971).

Regarding claim 12; PAPI in view of Smith discloses all of feature of claimed invention except for the step of capturing said series of two-dimensional diffraction patterns is carried out with a CCD camera. However, Lin et al ('971) teaches that it is known in the art to provide capturing said series of two-dimensional diffraction patterns is carried out with a CCD camera (14 of figure 3). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine PAPI with capturing said series of two-dimensional diffraction patterns is carried out with a CCD camera as taught by Lin et al ('971) for the purpose of selecting and classifying accurately defects on the sample.

Claim 66 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention in view of Smith as applied to claims 1 and 11

above, and further in view of Stearns et al (U.S. Patent No. 6,967,168).

Regarding claim 66; PAPI in view of Smith discloses all of features of claimed invention except for said defect comprises an amplitude defect in a multilayer coating wherein the step of repairing said defect comprises physically removing said defect from said multilayer coating and leaving a wide, shallow crater that exposes the underlying intact layers to restore the local reflectivity of the coating. However, Stearns et al teaches that it is known in the art to provide said defect comprises an amplitude defect in a multilayer coating wherein the step of repairing said defect comprises physically removing said defect from said multilayer coating and leaving a wide, shallow crater that exposes the underlying intact layers to restore the local reflectivity of the coating (abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine PAPI with said defect comprises an amplitude defect in a multilayer coating wherein the step of repairing said defect comprises physically removing said defect from said multilayer coating and leaving a wide, shallow crater that exposes the underlying intact layers to restore the local reflectivity of the coating as taught by Stearns et al for the purpose of minimizing defects in the components producing by an EUV lithography.

Allowable Subject Matter

Claims 10, 21-65 and 67 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record, taken alone or in combination, fails discloses or render obvious a method for characterizing and repairing defects using image reconstruction from diffraction patterns comprising all the specific elements with the specific combination including step of said sample is rotated around Ψ and Θ , and at each position a two dimensional diffraction pattern is recorded, wherein these diffraction patterns are parts of an Ewald sphere in reciprocal space, and wherein rotating said sample will lead to exploring the full reciprocal space by rotating said Ewald sphere in set forth limitation of claim 10.

The prior art of record, taken alone or in combination, fails discloses or render obvious a method for characterizing and repairing defects using image reconstruction from diffraction patterns comprising all the specific elements with the specific combination including step of said sample comprises a reticle with a thin film coating, wherein said reticle is for use in an extreme ultraviolet lithography (EUVL) system, wherein the step of repairing said defect comprises changing the thickness of said thin film coating in the vicinity of said defect in set forth limitation of claim 21.

The prior art of record, taken alone or in combination, fails discloses or render obvious a method for characterizing and repairing defects using image reconstruction from diffraction patterns comprising all the specific elements with the specific combination including step of said sample comprises a multilayer coating wherein said

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defect comprises an amplitude defect in said multilayer coating wherein said defect is selected from the group consisting of a particle, a shallow pit and a scratch, wherein the step for repairing said defect comprises removing said defect that is causing said amplitude defect from said multilayer coating wherein a damage region of said multilayer coating will remain after removal of said defects wherein said step for repairing said defect further comprises etching away said damage region in set forth limitation of claims 42.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chen et al (6684164) discloses true defect monitoring through repairing defect deletion; Takagi et al (6438438) discloses method and system for manufacturing semiconductor devices; Nagamura et al (6340543) discloses photomask, manufacturing method thereof; Asano et al (6335129) discloses method for repairing pattern defect on photomask; Neary et al (6016357) discloses feedback method to repair phase shift masks; or Atwood et al (5230970) discloses method of forming metal regions..

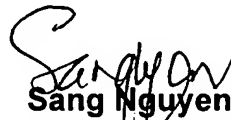
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sang Nguyen whose telephone number is (571) 272-2425. The examiner can normally be reached on 9:30 am to 7:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax

phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

June 21, 2006


Sang Nguyen
Patent Examiner
Art Unit 2877